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Thirty-Third Annual Report

OF THE

Agricultural Experiment Station

OF THE

Alabama Polytechnic Institute

Auburn, Alabama

January, 1921

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ALABAMA POLYTECHNIC INSTITUTE

Auburn, Ala., Jan. 28, 1921.

Governor Thos. E. Kilby,
Executive Department,
Montgomery, Alabama.

Sir:

I herewith transmit to you the Thirty-third Annual Report of the Agricultural Experiment Station of the Alabama Polytechnic Institute.

This report is made in accordance with the Act of Congress, approved March 2, 1887, establishing agricultural experiment stations, and the Act of Congress, approved March 16, 1906, known as the Adams Act.

Respectfully,

SPRIGHT DOWELL,

President.

Auburn, Ala., Jan. 28, 1921.

Dr. Spright Dowell, President,
Alabama Polytechnic Institute,
Auburn, Alabama.

Sir:

I herewith submit the Thirty-third Annual Report of the Experiment Station of the Alabama Polytechnic Institute for the fiscal year ending June 30, 1920.

It contains the detailed report of the Director, the Agriculturist, the Agronomist, the Plant Breeder, the Treasurer, the Chemist, the Veterinarian, the Botanist, the Horticulturist, the Entomologist, the Plant Pathologist, and the Animal Husbandman, for the year ending December 31, 1920.

Respectfully submitted,

J. F. DUGGAR,
Director, Experiment Station.

BOARD OF TRUSTEES

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SPRIGT DOWELL, President of the College

STATION STAFF

J. F. DUGGAR, Director of Experiment Station.

AGRICULTURE:

J. F. Duggar, Agriculturist
E. F. Cauthen, Agriculturist
M. J. Funchess, Soils
J. T. Williamson, Superintendent Co-operative Experiments
H. B. Tisdale, Associate Plant Breeder

VETERINARY SCIENCE:

C. A. Cary, Veterinarian

CHEMISTRY:

E. R. Miller, Chemist
O. N. Massingale, Assistant

BOTANY:

W. A. Gardner, Botanist
G. R. Johnstone, Assistant

PLANT PATHOLOGY:

----- Plant Pathologist

HORTICULTURE:

G. C. Starcher, Horticulturist
C. L. Isbell, Associate
Lyle Brown, Assistant

ENTOMOLOGY:

W. E. Hinds, Entomologist
F. L. Thomas, Associate
J. M. Robinson, Assistant

ANIMAL HUSBANDRY:

J. C. Grimes, Animal Husbandman
W. H. Eaton, Dairyman
G. L. Burleson, Assistant

REPORT OF HATCH AND ADAMS FUNDS FOR 1919-1920

Receipts

	Hatch Fund	Adams Fund
To amount from U. S. Treasury (Net) ..	\$15,000.00	\$15,000.00

Disbursements

By Salaries	7,700.00	10,433.80
By Labor	3,261.91	1,594.14
By Publications	877.62	
By Postage and Stationery	481.51	57.82
By Freight and Express	80.26	186.95
By Heat, Light, Water and Power	38.50	94.10
By Chemicals and Laboratory Supplies ..	18.66	375.70
By Seeds, Plants and Sundry Supplies ..	207.50	84.93
By Fertilizers	378.51	174.15
By Feeding Stuffs	388.63	779.05
By Library	397.65	42.25
By Tools, Machinery and Appliances ...	408.85	43.97
By Furniture and Fixtures	622.61	56.68
By Scientific Apparatus and Specimens ..	33.55	641.44
By Traveling Expenses	15.08	351.22
By Buildings and Lands	89.16	83.80

Total	\$15,000.00	\$15,000.00
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Respectfully,

M. A. GLENN,

Treasurer.

State of Alabama:

Lee County.

Personally appeared before me, B. L. Shi, a Notary Public in and for said county, M. A. Glenn, known to me as Treasurer of the Alabama Polytechnic Institute, who, being duly sworn, deposes and says the above foregoing account is true and correct. Witness my hand this the 24th day of January 1921.

B. L. SHI,

Notary Public, Lee County.

This is to certify that I have compared the account with the ledger account of the Treasurer, and this is a correct transcript of the same.

SPRIGHT DOWELL,

President Alabama Polytechnic Institute.

TREASURER'S REPORT, INVESTIGATIONS AT AUBURN
FUND, FOR THE YEAR ENDING JUNE 30, 1920

Receipts

To cash received from State November 1, 1919
to June 30, 1920 ----- \$3,750.00

Disbursements

By amount paid Administration -----	13.41
By Amount paid Agriculture -----	610.00
By Amount paid Entomology -----	50.00
By amount paid Horticulture -----	275.00
By amount paid Plant Pathology -----	553.94
By balance carried to July 1, 1920 -----	2,247.65

Total ----- \$3,750.00

Respectfully,

M. A. GLENN,

Treasurer, Alabama Polytechnic Institute.

Subscribed to and sworn to before me, this the 24 day of
January, 1921.

B. L. SHI,

Notary Public.

This is to certify that I have compared the account with
the ledger account of the Treasurer and this is a correct trans-
cript of the same.

SPRIGHT DOWELL,

President, Alabama Polytechnic Institute.

REPORT OF DIRECTOR

Auburn, Ala., Jan. 28, 1921.

Dr. Spright Dowell, President,
Alabama Polytechnic Institute,
Auburn, Alabama.

Sir:

I herewith submit the following report for the past year of the work under my charge as Director of the Experiment Station:

PUBLICATIONS

For the fiscal year ending June 30, 1920, the publications of the Experiment Station consist of the annual report, three bulletins, two circulars, and two press bulletins, making a total of eight publications. Below are given their titles and the authors:

Bulletin No. 209: "Time of Applying Nitrate of Soda to Cotton;" Part 1. Experiments at Auburn, 1910-1916. Part 2. Experiments in Various Alabama Counties 1914-1919. (April, 1920). By the Agriculturists.

Bulletin No. 210: "Time of Applying Nitrate of Soda to Corn;" Part 1. Experiments at Auburn, 1910-1916. Part 2. Experiments in Various Alabama Counties in 1914-1919. (April, 1920). By the Agriculturists.

Bulletin No. 211: "The Grape;" (June, 1920.) By the Associate Horticulturist.

Circular No. 42: "Cotton Worm Control;" (August, 1919). By the Entomologist.

Circular No. 43: "Annual Report of the Director of the Experiment Station on Work Done Under the Local Experiment Law in 1919." (Feb., 1920).

Press Bulletin No. 99: "Test of Varieties of Corn in 1919." (Nov. 17, 1919). By the Agriculturist.

Press Bulletin No. 100: "Tests of Varieties of Cotton in 1919." (Dec. 10, 1919.) By the Agriculturist.

Report No. 32: "Annual Report of The Agricultural Experiment Station." (Jan., 1920). By the Director.

WORK OF THE DEPARTMENTS

The reports of heads of departments included in this publication show the lines of experimental work in progress in each department of the Experiment Station.

BURNING OF THE AGRICULTURAL BUILDING

After the end of the fiscal year, but before the close of the calendar year, there occurred the greatest calamity in the history of the Experiment Station. This was the burning of the Agricultural Building (Comer Hall) with most of its contents from a fire of unknown origin.

The fire was discovered about midnight of Saturday, October 16, 1920, in a laboratory on the third floor, but had made too much progress to be arrested.

Inasmuch as a large proportion of the equipment and unpublished records in the greater number of departments was completely destroyed, it seems appropriate here to make a brief summary of the character of the losses sustained, which were as follows:

1. *Administration*—All furniture, books, correspondence files, publications previously issued by any department of the Experiment Station, and that part of the Experiment Station mailing list containing addresses from the following counties: Mobile, Shelby, Morgan, (most of it); Marshall; Walker; Pike, (part of it); and Tuscaloosa.

2. *Agromony*—All the posted ledger and other unpublished records of experiments for the years 1910 to 1920, inclusive; and all furniture and other equipment kept in the Agricultural Building; also the damaging by charring and by water of the volumes giving the records of field crop experiments for the years 1896 to 1909 inclusive; a large proportion of the earlier data, however, had been published. Fortunately most of the original records for 1920 were saved.

One of the greatest losses in this department, next to its ledger records, was the collection of about 4,000 photographic negatives. These illustrated every line of experimental work with field crops conducted by this Station during the past quarter of a century. Especially complete was the collection showing, by consecutive series of photographs made

of parent plants and plant progenies year after year, the inheritance of qualities in the cotton plant and also in the corn plant.

3. *Plant Breeding*—Practically the entire collection of records since the beginning of this work, including manuscripts in process of preparation summarizing the correlations found between numerous plant characters in the cotton, oats and corn plants, as determined in experiments extending over a period of more than ten years. Among the losses were the negatives mentioned above and a manuscript giving results of a number of years of work in comparing the yields resulting from continuous planting of light, heavy, and unselected cotton seed.

4. *Soils*—All furniture and other equipment, laboratory quarters and supplies; and all records of laboratory and field work, including samples and records relative to soils collected throughout the state in a study of the lime requirements, under the Local Experiment funds, of the principal soils of Alabama.

5. *Botany*—In this department the loss was complete, including records of the last few years, furniture, expensive scientific apparatus, a large collection of herbarium specimens, and the scientific section of the Experiment Station library. The latter was one of the most complete in this country in its collection of files of scientific journals in many languages, especially on the subjects of botany and plant pathology. It had been in process of collection as a part of the annual expenditure of the Experiment Station throughout a period of thirty-two years.

6. *Plant Pathology*—Complete loss of furniture, scientific apparatus, supplies; and records of the past year.

7. *Horticulture*—The loss in the department of horticulture, located on the first floor, consisted chiefly in a part of the furniture and a part of a collection of books, bulletins, specimens, and supplies.

8. *Animal Husbandry*—Likewise the department of animal husbandry, located on the first floor, was able to save most of its furniture and records, and of course the greater part of the

property of this division being stored in barns and elsewhere away from Comer Hall, was not involved in the fire.

9. *Entomology*—This department was also located on the first floor, and thus was able to save a considerable part of its furniture, much of which, however, together with books, records, specimens, and valuable cases for the storage of insect specimens, were lost. One of the greatest losses in this department was the extensive collection of photographs of insects and their injuries.

The only two departments of the Experiment Station that escaped any loss in the fire were the departments of Chemistry and of Veterinary Science. These were located in two separate wooden buildings some distance from the main Agricultural Building. Thus, while they escaped this fire, their danger from fire is continually greater than was the unexpected danger in the large new brick building that burned.

RECONSTRUCTION

Within two days after the fire was discovered all experiment station workers had been temporarily housed and had cheerfully begun work anew. Their present temporary quarters necessarily carry the inestimable handicaps of crowded space, inadequate facilities of every kind, scattered locations, lack of needed equipment of every kind, and increased danger from fire.

The tentative plan calls for the continuation of most of the experiment stations workers in these inadequate temporary quarters until the legislature of the state shall make provision for a fire-proof experiment station building. The insurance on the former agricultural building will not be adequate to restore it in full, but will be used, so far as it goes, chiefly for the reconstruction of a building for teaching purposes,—leaving for the legislature of 1923 the obligation of providing an adequate fire-proof experiment station building as a means of enabling this institution of research to render its maximum service to the farmers, horticulturists, dairymen, and other livestock raisers of the state.

Respectfully submitted,
J. F. DUGGAR,
Director.

REPORT OF AGRICULTURIST

E. F. CAUTHEN

Auburn, Ala., Dec. 29, 1920.

Director, J. F. Duggar,
Auburn, Alabama.

Dear Sir:

I respectfully submit a report of the experimental work in field corps under Hatch and Adams funds at the Alabama Experiment Station in 1920.

Cotton—The regular variety tests include a comparison of twenty-one short staple varieties. Owing to the poor stand of plants the results are not conclusive; therefore they are not published in press bulletin form. For observation purposes fourteen of the less common short staple varieties were grown and notes made on the general characters of these varieties. A great deal of data was taken on twelve common varieties to ascertain which characters were conducive to resisting boll weevil damage. Among these were the rate of blooming and the persistence of the young bolls under different seasonal conditions. The effects of thick and thin stands of plants on earliness and yield were repeated; also effect on earliness, type of plant, and yield of planting on a bed, on a level, and in a water furrow were studied. The comparison of light from light and heavy from heavy cotton seed on yields, germination and height of plants was repeated.

The planting of Cook and Cleveland varieties in plant-to-row tests was repeated and notes and measurements were taken along the same lines as in the previous years.

Data on all these lines of work, except yields of 1920, were lost by fire.

The black and green seed found in the strain 588 of Cook have not all been removed by three years of planting it in a plant-to-row test. Cook 1010 and also 1110 are promising strains for both productiveness and earliness. The 1010 is being multiplied and distributed by several farmers. The new promising strains from Cook and Cleveland grown at the Ex-

periment Station for multiplication purposes in 1920 have produced well and have been saved, but their pedigree numbers were lost in the destruction of our records.

Corn—Fourteen varieties of corn were tested on the Experiment Station Farm. These were planted early and the results of their yields published in press bulletin No. 102. Eleven varieties were planted after harvest of grain and notes made on their adaptation to late planting. Comparison of five varieties, thought to be suited for silage purposes, was made with three varieties of late growing sorghums. The yields show that the sorghums make considerably larger tonnage.

Oats—The regular fall planted variety test of the most promising varieties and strains from our breeding work was repeated. A spring planting of seven leading varieties was made to ascertain which seemed best suited for late or spring planting. The fall- versus spring-planted test of Red Rust Proof and Burt varieties, which has been in progress many years, was repeated. From these long planted varieties at the Alabama Experiment Station special selections were made for the purpose of getting new and pure strains. The breeding work with oats is being conducted along the same lines as in previous years.

Wheat—In addition to the regular variety test of wheat four varieties are being tested cooperatively with the North Carolina, the South Carolina, and Georgia Experiment Stations. These varieties represent a most promising variety from each station. Six of the leading strains of wheat grown in our multiplication test were sold to farmers and in three cases promises were secured from the farmers to keep the strains pure and to sell their surplus for planting purposes.

Rye—The regular variety test of rye was repeated. Rye with vetches was planted to study methods of collecting vetch seed.

Soy Beans—The regular variety test for seed was repeated. A test of the same varieties for hay purposes was made. The vining habit of Barchet and the semi-vining habit of Ootootan make these varieties especially adapted to production of hay.

Varieties of Vetch—The Bureau of Plant Industry of the U.

S. Department of Agriculture furnished the Experiment Station with a collection of the most promising varieties of vetch for Southern conditions. These were planted for a study of hay production, and of methods of collecting seed.

Commercial Fertilizers—The different dates of applying nitrate of soda to cotton gave results in confirmation of those of previous years. The same test with corn gave practically the same results as secured in former years. The test of a comparison of the fertilizing effects of cottonseed meal, peanut meal, velvet bean meal, and nitrate of soda on cotton was repeated; also a test of a comparison of calcium cyanamid, ammonium sulphate, ammonium nitrate and nitrate of soda on cotton was made. The results of the test of this year showed ammonium sulfate slightly better than either of the others; however, it was followed closely in the order named by ammonium nitrate, nitrate of soda and calcium cyanamid. Equal amounts of nitrogen from nitrate of soda, calcium cyanamid, and ammonium sulfate (these fertilizers having been applied continuously on their respective plots for thirteen years) gave, on a cotton crop, the largest results in 1920 when applied in the form of calcium cyanamid; the ammonium sulfate plots showed the harmful effects of its long use by making a very defective stand of cotton plants. Acid phosphate versus raw phosphate on cotton in a test where these fertilizers have been applied twice a year for a period of twelve years show that phosphoric acid in the form of acid phosphate was in 1920 slightly more beneficial than in rock phosphate.

Potash from "nitrapo" and other sources was applied to corn and sorghum. There was very little difference in yield from the different sources.

Tests of different dates of application of nitrate of soda, sulfate of ammonium and calcium cyanamid on fall planted Red Rust Proof oats show that the largest yield in 1920 came from the application made February 20, except in the case of the cyanamid, which gave its largest yield from the application made March 10. Of the different forms of nitrogen, that in the nitrate of soda was most effective.

In addition to the experiments mentioned above the following were also conducted on the Experiment Station Farm at Auburn:

Alfalfa with a nurse crop.

Clovers, species of.

Species and varieties of grasses.

Limed versus not limed crops.

Japanese sugar cane vs. sorghum for forage and for syrup.

Effects of kudzu in smothering nut grass and for soil improvement.

Peanuts, variety test, liming, and rate of seeding.

Rotation of crops, highly fertilized and moderately fertilized.

Varieties of sorghum for forage.

The effect of biennial subsoiling on cotton, corn and cowpeas.

Velvet bean variety test.

Cowpea variety test.

Residual effects of crops of corn, sweet potatoes, cowpeas, chufas, and others on cotton.

Loss of Records—On October 17, 1920, practically all the records of the field experiments made from 1910 to 1920 were lost by fire. The data on light versus heavy cotton seed secured during the past twelve years, which had been prepared for publication were lost; also the data on the different methods of planting and fertilizing corn including twelve years work with the Williamson method; the breeding work on oats; the data on a comparison of acid and rock phosphate for six years.

However, a fairly complete record of the yields in 1920 of the principal field crops on the Alabama Experiment Station Farm have been recompiled from detailed records that escaped the fire.

Respectfully submitted,

E. F. CAUTHEN,

Agriculturist.

REPORT OF AGRONOMIST

M. J. FUNCHESS

Auburn, Ala., Dec. 8, 1920.

Mr. J. F. Duggar, Director,
Auburn, Alabama.

Dear Sir:

I beg to submit the following report of the work done under the Adams and the Hatch Funds:

Adams Fund—The work on Manganese and Soil Acidity was continued along lines similar to those of previous years. However, all of the records of my work were lost in the October fire, so that I am unable to make any report further than to say that certain manganese compounds, especially the carbonate, appeared to be favorable to nitrification in very acid soils. But this compound did not materially benefit higher plants. On higher plants growing in very acid soils, manganese carbonate, sodium carbonate and potassium carbonate were found to produce not as good results as calcium carbonate. This line of work is being continued on a large scale but I have not enough data to warrant a discussion at this time.

Hatch Fund—All records of my pot experiments on the value of different forms of lime and on different rates of liming were also lost. During the past summer, I made an acidity determination on the soil of each of the thirty-nine pots in these experiments and found that only where a considerable excess of lime had been used in the initial application was the soil not acid. Where lime in small amounts had been used, even though the soil was still sour, a marked effect from the lime has been noted each year. About one-half of this experiment must be abandoned, as the outline was destroyed and I do not recall the plan sufficiently well to warrant continuing the work on exactly the former plan. On the other hand, I do remember the plan sufficiently well to continue this project until enough data is obtained to make the experiment worth while.

I am unable because of the fire to give a more detailed report of the work of the past season than the foregoing.

Very truly yours,
M. J. FUNCHESS,
Agronomist.

REPORT OF PLANT BREEDER

H. B. TISDALE

Auburn, Ala., Dec. 20, 1920.

Prof. J. F. Duggar,
Auburn, Alabama.

Dear Prof. Duggar:

The following is a brief report of my work under the Adams and Hatch funds for the year 1920.

The corn breeding work was continued with Whatley's Prolific, a white dent weevil resistant variety. All data which had been collected on this work in past years and the correlations and summaries of the data which were well under way for publication were destroyed. In the late fall of 1920 data were taken for the continuation of the study of correlations of the different ear characters of corn and the study of shuck covering as related to yield and weevil resistance.

A modified ear-to-row method is used to test the different strains of Whatley corn. The best strains are rapidly multiplied and disseminated.

The plant-to-row test of White Spanish peanuts was continued. Ninety-seven individual selections representing almost as many types of White Spanish peanuts were planted. Data were taken on a large number of these plants for the purpose of correlating the different plant and fruit characters.

Several germination experiments were made with peanuts in which were compared the rate and amount of germination of shelled seed, nuts in broken pods and nuts unshelled. Experiments on the effect of age on shelled peanuts were made. Experiments indicate that the most economic results are obtained from planting nuts shelled by hand; and that the germinating power of shelled peanuts decreases with age. Further experiments, however, are necessary in order to draw very definite conclusions.

Respectfully submitted,

H. B. TISDALE,
Associate Plant Breeder.

REPORT OF BOTANIST

WRIGHT A. GARDNER

Auburn, Ala , Jan. 17, 1921.

Director J. F. Duggar,
Auburn, Alabama.

Dear Sir:

As recently requested, I submit the following annual report.
Adams Fund.

Soil Toxin Project—The work of the year consisted largely of extending and confirming earlier results. More soils were found to contain organisms able to decompose certain toxins. The nearly completed manuscript of a bulletin on the decomposition of non-nitrogenous toxins was destroyed when the Agricultural Building burned, as well as a considerable mass of data on the decomposition of nitrogenous toxins.

Sweet Potato Project—The considerable data on the physiological effects of various conditions of harvesting, curing, and storage of sweet potatoes, accumulated during the early months of the year, were lost in the fire of Oct. 16-17.

The latter part of the year has been devoted to replacing equipment, soils, and toxins for the purpose of restoring, first the data on soil toxins and later that on the physiology of sweet potatoes. The Department is again ready for constructive work on the soil toxin project.

Hatch Fund.

Miscellaneous Projects, not definitely outlined, were continued with some work on each.

1. Manganese poisoning.
2. Sprouting early Irish potatoes for a second crop.
3. Nut grass eradication.
4. Nutrient solutions.

Respectfully submitted,
WRIGHT A. GARDNER,
Botanist.

REPORT OF HORTICULTURIST

G. C. STARCHER

Auburn, Ala., Dec. 2, 1920.

Prof. J. F. Duggar, Director,
Experiment Station,
Auburn, Alabama.

Dear Sir:

I submit herewith a report of experimental work for the year 1919-20.

Grape Variety Project—Study of the behaviour of forty-eight bunch grapes and six Rotundifolia. Project started in 1912. Completed in 1918. Bulletin published, "The Grape," No. 211, June, 1920, which was burned and later reprinted in smaller edition.

Results: The behaviour of the various varieties was very striking, only a few of the entire group proving commercially profitable.

These varieties have been selected for a new series of experiments, planting being made in 1919. The new series of experiments will show comparative behaviour when the vines are fertilized and sprayed. Under the first series of experiments the vines were not sprayed in order to test the relative hardiness of foliage and vine under natural conditions.

Sweet Potato Curing Project—This project was a continuation of the curing work carried on under a similar project covering the period of 1914-15-16, but was changed to cover a much broader field during the years 1917-18-19. The second three years series was completed in June and data prepared for publication. These data will show striking results due to frost and cold damage, both before and after harvesting, and form the basis of a new and more extended series now under way.

The results of the two series already completed will have a widespread influence on the sweet potato industry. In fact many other States have adopted almost verbatim recommendations made by this Department as result of our experiments and observations.

The following projects have been continued:

Apple, pear, peach, quince, pecan and sweet potato variety studies. The apple varieties cover a list of fifty varieties, pear, twelve varieties; peach, thirty varieties; quince, three varieties; pecans, ten varieties; sweet potatoes, ten varieties.

Notes for two years were completed on our strawberry planting of twenty-nine varieties but a part of these notes were destroyed when the Agricultural Hall burned. Our notes are so complete for 1919, however, that we can base a new planting and continuation of the variety studies on that year's work.

A series of variety studies on sweet potatoes has been completed and is being prepared for publication. A new series, started with plants secured from the U. S. Department of Agriculture, is now under way.

A planting was made of high-grade huckleberries for observation of this new horticultural plant.

Our variety planting of raspberries, blackberries, dewberries, and loganberries was destroyed by live stock.

Soil sterilization and fertilizer studies are being made with a number of plants in the greenhouse, such as chrysanthemums, carnations, sweet peas and roses.

The variable character of our soil has made fertilizer studies of plants enumerated above practically impossible and the limited amount of ground available, and its character, makes any experimental work of any character with horticultural plants extremely difficult and unsatisfactory.

Respectfully submitted,

G. C. STARCHER,
Horticulturist.

REPORT OF ENTOMOLOGIST

W. E. HINDS

Auburn, Ala., Jan. 11, 1921.

Prof. J. F. Duggar, Director,
Alabama Experiment Station,
Auburn, Alabama.

Dear Sir:

I submit herewith a statement regarding Adams and Hatch work done by the Department of Entomology for the calendar year 1920.

Adams Fund Work—On January 1, 1920, two active projects were under way in this Department. First, the Rice Weevil, or Control of Insects Affecting Stored Corn. The progress in this work had been such that it was considered advisable to close it up on June 30, 1920.

In this investigation it was learned that a large part of the annual loss in corn, amounting to from four to ten million dollars per annum in Alabama alone, may be prevented by making a few simple and feasible changes in seed selection and in the time and method of planting, harvesting and storing corn crop. Loss from grain infesting insects is greatest near the Gulf Coast and decreases to where it becomes a negligible amount in most seasons at a distance of about two hundred miles from the Coast.

The following recommendations have been determined from this project: First, select, preferable from standing stalks in the field in the fall, only such seed ears as have long, tight fitting shucks or husks in addition to every character desired. Seed selection should be on the basis of the maximum yield of sound grain per stalk rather than upon the show-type of ear. For insect resistance, pendent ears are highly desirable and for large yields prolific types or corn usually excel. Some of these types have been found very desirable in weevil resistant characters as well as in productiveness. Second, the control of insects can be secured very satisfactorily in the field by planting, preferably near the corn crib or on the side of the field nearest adjacent timbers, a small area of early maturing corn

as a trap plot to concentrate the egg deposition for the first generation of all species of these grain infesting insects in the field.

To be effective, the trap plot should mature two or three weeks earlier than the main crop. To prevent the spread of the first generation of insects from the trap plot to the main crop all of the ears from the trap plot should be gathered with shuck on within six weeks after the corn reaches roasting-ear stage. This removes the first generation from the field and gives very efficient protection to the main crop at a minimum expense and with no insecticidal treatment.

It has been found that the common practice in the South of storing corn in the slip-shuck actually results in increasing the weevil damage during storage. Where corn is shucked in the field or before it is thrown into the crib only a small part of the adult insects in the ears in the field will be carried to the crib. The insects are deprived of a large part of the shelter against winter minimum temperatures that the shucks would provide. It is advisable to put a few moth balls (naphthalene), say, one pound per twenty square feet of area of the crib, on top of the stored grain to repel the attacks of grain moths. The use of this material does not effect either the feeding value or germination of the grain and the expense involved is very slight; on the other hand storing corn with the shuck on and applying salt in the crib, as is frequently done, increases the insect damage decidedly, as salt takes up moisture from the air and the moisture softens the grain. The insect can work and develop faster in moist, soft grain than they do in dry, hard grain. Salt thus used is not insecticide in its effect in any degree.

The recommendations resulting from this investigation are applicable throughout the South Atlantic and Gulf States. If brought into general application they may go far toward preventing an annual loss averaging at least \$40,000,000. These improved measures can be applied by every grower, owner or tenant, white or black, with practically no expense or additional labor involved.

Fumigation—Continued work on this subject showed that

it was so broad in scope that it seemed advisable to close up the original project and select some phase of the subject for further investigation. Accordingly before July 1st, the new project growing out of the fumigation work was outlined under the title of "Soil Insecticides." Even this phase of the subject, which would have included other materials besides soil fumigants, appeared too comprehensive and after some work had been done, the project was discontinued by Dr. F. L. Thomas who was to have prosecuted this work and two new projects have been outlined and approved for him. These are described under the head of *New Projects*.

Another phase of the fumigation project has also been selected as a subject for a newly stated investigation to receive the attention of the Head of the Department.

New Projects—In mid-summer of 1920 the Mexican bean beetle, *Epilachna corrupta* Muls., was discovered in north central Alabama. This insect is not known to occur elsewhere in the United States except in a region in and around Arizona, Colorado and New Mexico where the species seems to have been confined by surrounding desert and range conditions. Insamuch as this insect has already given evidence of the acquirement of new breeding habits and food plants in Alabama and *promises to become possibly the most serious insect pest yet introduced into the United States*, it has seemed advisable to make this insect the principal subject for Adams Fund investigations in this Department. Therefore, Dr. F. L. Thomas will henceforth devote the major part of his attention to the project Mexican Bean Beetle. In this project a special study is to be made of life history, including dispersion, hibernation and natural control. This project has been approved.

The second project approved for Doctor Thomas is the Turnip Web-Worm. Work on these two projects is now under way but it is too early to report results thereon.

The third project for the Department, entitled Species Factor in Insect Resistance to Fumigation has been submitted and with the restriction of materials to be tested to a small number of items definitely stated will doubtless be approved. Work on this project cannot exceed six or seven weeks of the year

and this work will be done according to present plans in the spring months.

Hatch Fund—Inasmuch as the expense apportionment of Hatch Fund to the Department has amounted to only \$100. per annum, no major project could be undertaken. The principal work has therefore been on a subject Miscellaneous Insect Studies. Under this we have dealt principally with unusual outbreaks of insects which are already established in the State.

A report of work under the Local Experiment Fund will be submitted separately.

Respectfully submitted,

W. E. HINDS,
Entomologist.

REPORT OF ANIMAL HUSBANDMAN

J. C. GRIMES

Auburn, Ala., Jan. 13, 1921.

Prof. J. F. Duggar, Director,
Alabama Experiment Station,
Auburn, Alabama.

Dear Sir:

I beg to submit herewith a brief report of the experimental work conducted under the Hatch and Adams funds by the Animal Husbandry Department during the past fiscal year, as carried on under the direction of my predecessor, Prof. George S. Templeton, who was in charge of the Department of Animal Husbandry until September 1, 1920.

*UNDER HATCH FUND**Dairy Cattle*

A test was conducted comparing a mixture of velvet bean meal and cottonseed meal versus wheat bran and cottonseed meal when supplemented with silage and hay, as a feed for dairy cattle.

Object of Experiment

The object of this experiment was to determine the relative value of velvet bean meal with wheat bran as influencing:

1. Production of milk.
2. Production of butterfat.
3. Feed cost of milk and butterfat.
4. Weight of cows in milk.

Plan of Experiment

Two lots of three cows each were used in the experiment. They were fed for 28 days as follows:

- Lot 1. Velvet bean meal 2 parts, cottonseed meal 1 part, hay and sorghum silage.
- Lot 2. Wheat bran 2 parts, cottonseed meal 1 part, hay and sorghum silage.

At the close of this period 14 days were used in which to reverse the ration of the two lots. During the second period of 28 days they were fed as follows:

Lot 1. Wheat bran 2 parts, cottonseed meal 1 part, hay and sorghum silage.

Lot 2. Velvet bean meal 2 parts, cottonseed meal 1 part, hay and sorghum silage.

The cows on the ration including velvet bean meal consumed more grain but slightly less silage and hay. They produced less milk but more butterfat than those on the wheat bran ration. Some of the cows on the velvet bean meal test produced milk higher in butterfat than that from the cows receiving wheat bran. The wheat bran ration produced milk and butterfat at slightly less cost than the velvet bean ration.

It is planned to repeat this experiment at a later date in order to get additional data.

Hogs

A test was started January 20th, 1920, to determine the influence of a ration of velvet beans alone on brood sows. Four brood sows which were bred were placed on the ration composed entirely of velvet beans. Three litters have been farrowed to date and the experiment is still in progress.

UNDER ADAMS FUND

Hogs

A continuation of the project in cooperation with the Department of Chemistry and the U. S. Department of Agriculture to determine the influence of some southern feeds on the properties (melting points, iodine value, keeping qualities, and color) of lards. The experiment was conducted with six lots of hogs as follows:

Lot 1—6 hogs; corn 8 parts, 60% tankage 1 part.

Lot 2—6 hogs; corn 7 parts, peanut meal 1 part.

Lot 3—6 hogs; corn 2 parts, peanut meal 1 part.

Lot 4—6 hogs; corn 1 part, peanut meal 1 part.

Lot 5—6 hogs; corn and peanut meal in self feeder.

Lot 6—3 hogs; whole Spanish peanuts.

This experiment was planned with a view of determining the influence of various amounts of peanut meal on the carcass; the influence of age on the carcass. The finish of the hog was also watched in this experiment.

The hogs were fed from March 20, 1920, to June 29, 1920, a

period of 101 days. They were then shipped to Beltsville, Maryland, and slaughtered in the Government abattoir. They were kept in cold storage for 48 hours and at the end of this time the carcasses were classified by the grading committee. Samples of kidney fat were taken for melting point and iodine value determinations.

Classification, average melting point, and iodine values were as follows:

LOT	CLASSIFICATION	MELTING POINT		IODINE VALUE	
		Leaf fat	Back fat	Leaf fat	Back fat
		Degree C.	Degree C.		
1.	3 firm, 2 medium	42.1	37.3	56.95	61.66
2.	4 firm, 2 medium	40.1	36.3	56.69	63.21
3.	2 firm, 3 medium	41.0	34.9	58.40	66.19
4.	3 firm, 2 medium	40.2	36.3	61.98	66.49
5.	2 firm, 3 medium	37.6	32.3	58.10	66.09
6.	3 soft	30.8	25.1	79.53	81.52

Three of these hogs, one firm, one medium, and one soft were cut up. The hams, bacons, and shoulders from these three hogs were cured, one ham, one bacon, and one shoulder from each carcass being cured by the brine method and the others by the dry method. All of the other carcasses were sold without being cut up.

Respectfully submitted,

J. C. GRIMES,

Head, Animal Husbandry Department.

REPORT OF CHEMIST

E. R. MILLER

Auburn, Ala., Jan. 1, 1921.

Prof. J. F. Duggar, Director,
Alabama Agricultural Experiment Station,
Auburn, Alabama.

Dear Sir:

I beg to submit the following report of the work of my department for the year ending Dec. 31, 1920.

Further work has been done in the determination of the mineral matter of various varieties of the velvet bean as well as of the Chinese, Yokohama and Lyon beans.

The phenolic substance referred to in my last report has been identified as the 3:4-dihydroxy phenylalanine, which was reported, in 1913, by Guggenheim to be a constituent of the green pods of *Vicia faba*.

The results of my investigations were published in the Journal of Biological Chemistry, vol. 44, pp. 481-486.

This amino acid we have found to be contained also in the flowers, stems and immature pods of the velvet bean, but so far the results seem to indicate that it is not present in the mature pods and leaves. Its identification in these parts of the plant is rendered difficult by the presence of another phenolic substance which has some of the characteristics of tannin.

For several reasons this amino acid is of considerable interest, particularly so, since it is quite probable that it is directly or indirectly one of the causes of the undesirable results which follow when velvet beans are fed in large quantity to brood sows.

In cooperation with the Animal Husbandry Department a feeding experiment with pigs is also in progress, the object of which is to find out in what respects the velvet bean may be deficient as a feed stuff.

Respectfully yours,
EMERSON R. MILLER,

REPORT OF PLANT PATHOLOGIST

A. F. THIEL

Auburn, Ala., Nov. 15, 1920.

Director J. F. Duggar,
Auburn, Ala.

Dear Sir:

I herewith submit a report of the work in plant pathology for the past year under the Adams fund project.

Until April 1, 1920, the work was conducted by Dr. E. F. Hopkins.

Our study of seed-borne diseases of southern forage plants has included this year a continuation of the study of leaf spot of bur clover begun some years ago at the Alabama Experiment Station by Dr. F. A. Wolf; and experiments intended to find a method of control for the leaf spot of vetch.

The destruction of all records in this department in the fire that consumed the agricultural building in October, 1920, makes possible only an outline of results, prepared from memory, and necessitates the repetition of a part of this work, as well as the continuation of the same line of investigations.

LEAF SPOT OF BURR CLOVER

(*Cercospora Medicaginis*)

Description of organism: "Stevens Fungi Which Cause Plant Diseases." Page 630.

The organism causing the leaf spot of bur clover is seed borne. Dr. Hopkins, experimenting with various methods, found that by using hulled seeds he secured 100% healthy plants when the diseased seed were treated with 40% formaldehyde for 2 hours or with a 1:1000 mercuric chloride solution. Treated seeds were inoculated again after treatment. By treating the seed with hulls attached no satisfactory results were obtained. Dr. Hopkins' results will be published soon.

*LEAF SPOT OF VETCH**(Ascochyta pisi)*

Literature:

Halsted, B. D. N. J. R. 14:355, 1893.

Van Hook, J. M., O. B. 173: 1906.

Kruger, F., C. Bak. 1:620, 1895.

The fungus causing the leaf spot on vetches attacks the stems, leaves, pods and seeds. The following varieties are more or less resistant: Oregon vetch, Crown vetch, *V. monanthus*, *V. ervilla*. Those extremely susceptible are *V. angustifolia* and *V. sativa*.

Preliminary experiments on control indicated that the leaf spot may possibly be controlled by subjecting the diseased seed, with a water content slightly higher than normal, to high temperatures.

Since the results of the experiments of different temperatures and water content were lost in the fire, it is advisable to repeat the work.

Respectfully submitted,

A. F. THIEL,

Acting Plant Pathologist.

REPORT OF VETERINARIAN

C. A. CARY

Director J. F. Duggar.

Sir:

The following is a brief report of work done by the Veterinary Department during 1920.

1. Tests were made on pigs, cattle and mules to determine the toxic action of red buckeye. The fruit, leaves, twigs and roots were employed. Only in one instances or test did there appear toxic effect. One 700 pound mule was given, by stomach tube, 1 gallon of liquid obtained by macerating 4 pounds of buckeye roots. Sixteen hours thereafter this mule presented some symptoms of intoxication. The mule would walk backwards and forwards and press its head against the fence; but when driven around in the lot it was lively and active. Its abdomen was sensitive to palpation and there were some signs of abdominal pain. The pulse was soft and weak; and the mucous membranes were pale. Twenty-four hours after the administration of the macerated material all symptoms had disappeared and the mule was apparently normal.

The test on hogs cattle and another mule were all negative. Some of these tests on cattle and mules will be repeated.

In connection with the Chemical and Animal Husbandry Departments the pathology and bacteriology of the changes in brood sows resulting from an exclusive velvet bean ration have been studied. This study also embraced a study of the pigs born from such sows. We are not ready to publish results.

The Farmers' Summer School for 1920 was held July 31 to August 7, 1920. The attendance and interest were very good. There were 47 counties, 9 states, represented, and 625 in attendance.

C. A. CARY,
Veterinarian.